Energy, Mines and Resources Canada
Hon. Marcel Masse, Minister

Énergie, Mines et Ressources Canada
L'Hon. Marcel Masse, Ministre

ENERGY IN CANADA: AN OVERVIEW

Discussion Paper
Energy, Mines and Resources Canada
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Canada

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FOREWORD FROM THE MINISTER

Energy is exceptionally important in the Canadian economy. Not only are we the world's largest consumers of energy per capita, but we are also major producers of energy, including significant amounts for export.

In 1986, our energy sector confronted a significantly changed and more uncertain world, which affected both consumers and producers. Canadians of all regions should carefully reconsider our prospects and challenges in this new world. I welcome the occasion to review these issues with my provincial colleagues at the first federal-provincial meeting of energy ministers since 1978. This is consistent with the Government of Canada's determination to work for federal-provincial understanding and cooperation in a matter which for too long was allowed to divide us.

This background paper was prepared by my officials to provide conference attendees with factual material on the evolution of our energy sector and to sketch out some current issues. I am pleased to distribute it more widely as a contribution to public information and discussion.

Marcel Masse

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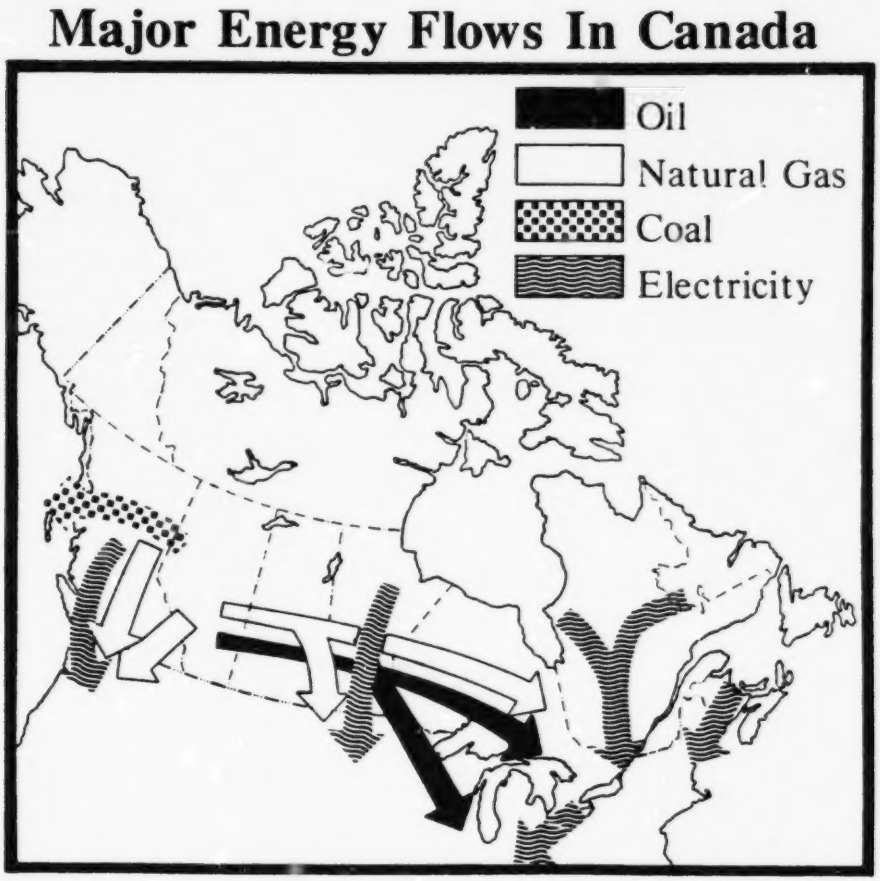
1.0 PREFACE

The global and domestic energy scene has changed dramatically over the past year. Oil prices, which have recently strengthened, nonetheless remain low and volatile. The Chernobyl disaster has heightened public awareness and concern over the safety of nuclear energy. And there is increasing debate about the environmental costs of energy production and consumption.

These recent events should be seen in the context of the longer term factors shaping the way Canadians produce and consume energy. Canada, like other Western countries, has significantly reduced both the share of oil in our energy mix and our dependence on foreign oil supplies in the last decade. In energy terms, our regions vary enormously in what they produce and consume; the current and potential contribution of the energy sector to their economies; and their position as energy exporters or importers. Canada draws great strength from the wealth and diversity of its energy resources and the interdependent interests of our regions in realizing their potential.

This paper provides a broad perspective on the energy issues that challenge Canadians today by reviewing the critical characteristics of Canada's energy system, and considering the role of governments in responding to current challenges.

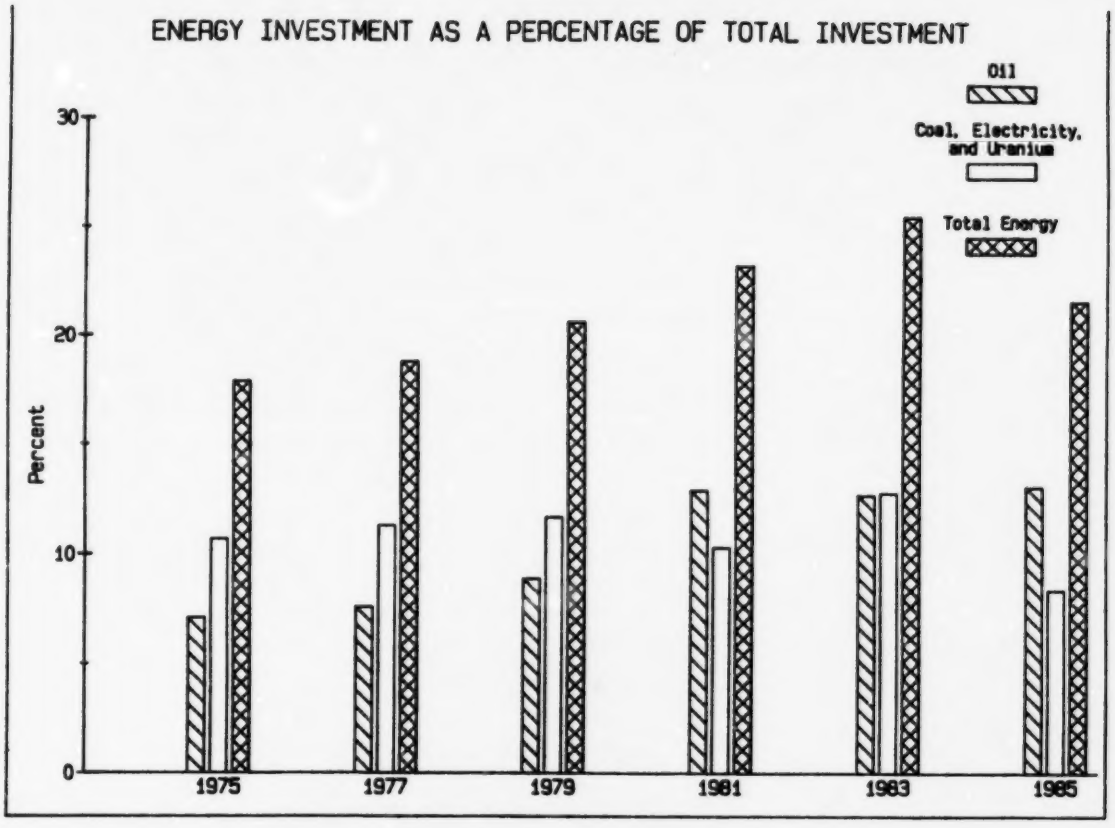
2.0 ENERGY IN CANADA



2.1 Energy Resource Potential

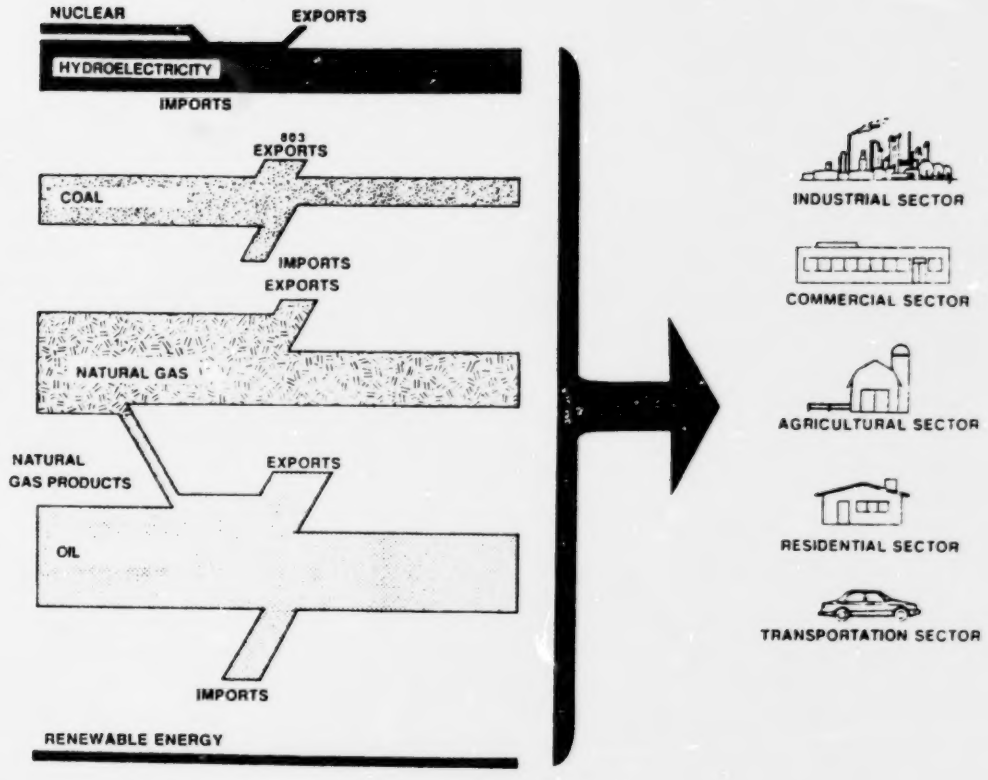
Geology and geography have provided Canada with vast and diverse energy resources. At present rates of production, Canada has enough proven oil reserves to last about ten years, natural gas to last more than 35 years, coal to last more than 100 years, and uranium to last more than two decades. Beyond this are huge potential reserves of these resources. Potential oil sands reserves, for example, are equivalent to the combined proven reserves of the three largest OPEC producers (Saudi Arabia, Kuwait and the United Arab Emirates). The offshore and northern territories are estimated to have discovered crude oil resources equivalent to almost five years of current production and a much greater long term potential. Largely unexploited hydro resources exist in Quebec, Manitoba and British Columbia, and enormous reserves of coal are concentrated in British Columbia and Alberta. Renewable energy, notably biomass, can also contribute significantly more to our energy mix.

2.2 Energy in the Economy



The energy sector is a vital component of Canada's industrial economy, directly employing more than 300,000 people. It accounts for 7 per cent of our Gross Domestic Product and 13 per cent of the value of our exports. Energy has had a particularly important share of capital investment in Canada; oil and gas normally represent about half of the energy sector's contribution. This investment has created many thousands of jobs in the manufacturing sector of our economy, and permitted Canadians to become significant exporters of energy-related equipment and services. The severe decline in oil prices in 1986, however, had a major impact on the total level of capital investment in our economy last year.

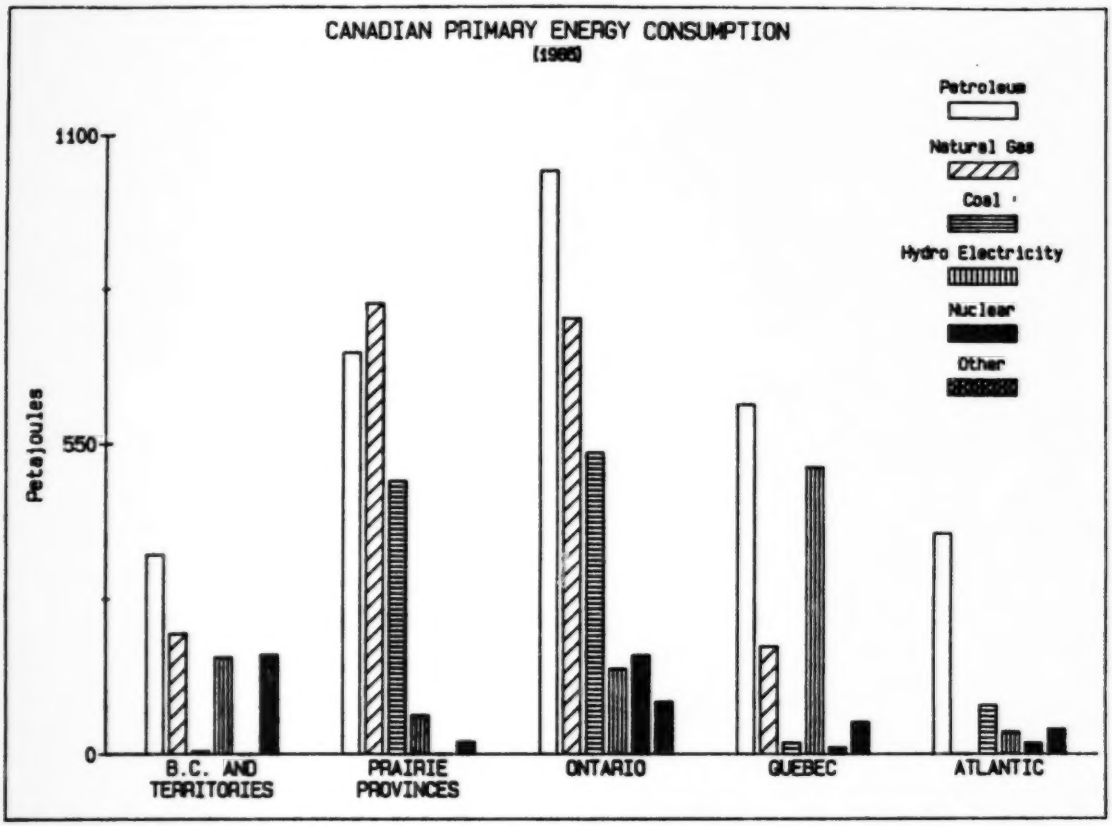
ENERGY USE BY FUEL TYPE



Canada is a large industrial economy whose economic growth has been fed by abundant and low-cost natural resources, particularly energy resources such as coal, oil, natural gas and hydroelectric power. Together with our long distances and harsh climates, this has made Canada the most energy intensive industrialized country in the world.

Domestic energy industries are a vital source of the energy that powers our economy and supports our way of life. They supply Canadians with three quarters of their oil and virtually all of their natural gas and electricity. The energy required for thermal electrical generation is also met very largely by Canadian production. Canada's conservation and renewables industry is an increasingly important sectoral component of the energy industry, with some $5.5 billion in sales in 1985.

2.3 Energy Consumption and Production



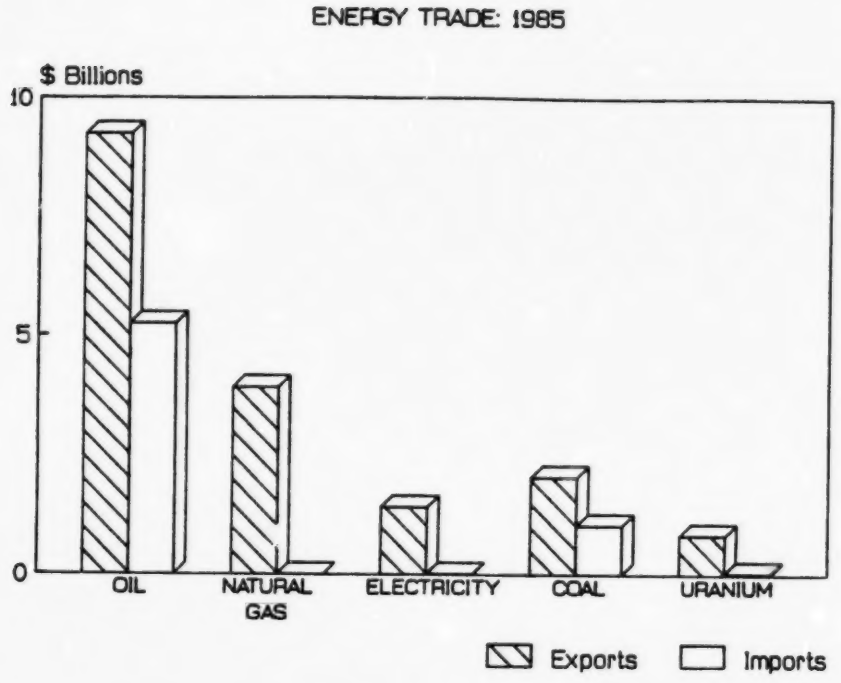
Energy consumption in Canada is characterized by regional and sectoral diversity, conditioned by the availability and cost of competing fuels and the structure of the regional economy. Natural gas dominates primary energy requirements in the Prairie Provinces, but is also a major source of energy in Ontario. Although coal plays an important role in Ontario, the Prairie Provinces and Maritime Provinces, it is relatively insignificant in Quebec and British Columbia.

All parts of Canada rely on petroleum to meet their energy needs. In total, petroleum represents almost 40 per cent of Canada's primary energy consumption, ranging from a high of 68 per cent in the Atlantic Provinces, to a low of 34 per cent in the Prairie Provinces. For the most part, this is due to the importance of the transportation sector throughout Canada and its heavy reliance on petroleum products -- 98 per cent of the energy needs of the transportation sector are met by petroleum products.

Canada's diverse and geographically dispersed resource base gives rise to regional variations in the sourcing of energy commodities. Ontario relies almost exclusively on crude oil from Alberta whereas the Atlantic Provinces, and to a lesser extent Quebec, rely on offshore sources. Despite a mature petroleum industry, British Columbia imports about three quarters of its crude oil requirements from Alberta. Domestic natural gas moves farther east than oil does, but does not enter the Atlantic Provinces.

With the exception of the Atlantic Provinces, very little electricity moves between provinces. Moreover, the electrical industries within each province tend to rely on a distinctive mix of generation technologies. Newfoundland, Quebec, Manitoba, British Columbia and the Northwest Territories rely primarily on hydro based systems. Nova Scotia, Saskatchewan and Alberta rely primarily on conventional thermal generation from coal. Prince Edward Island has oil-fired capacity but imports most of its power from New Brunswick. New Brunswick and Ontario rely significantly on nuclear power although conventional thermal and hydro plants are also important.

2.4 Energy and Trade



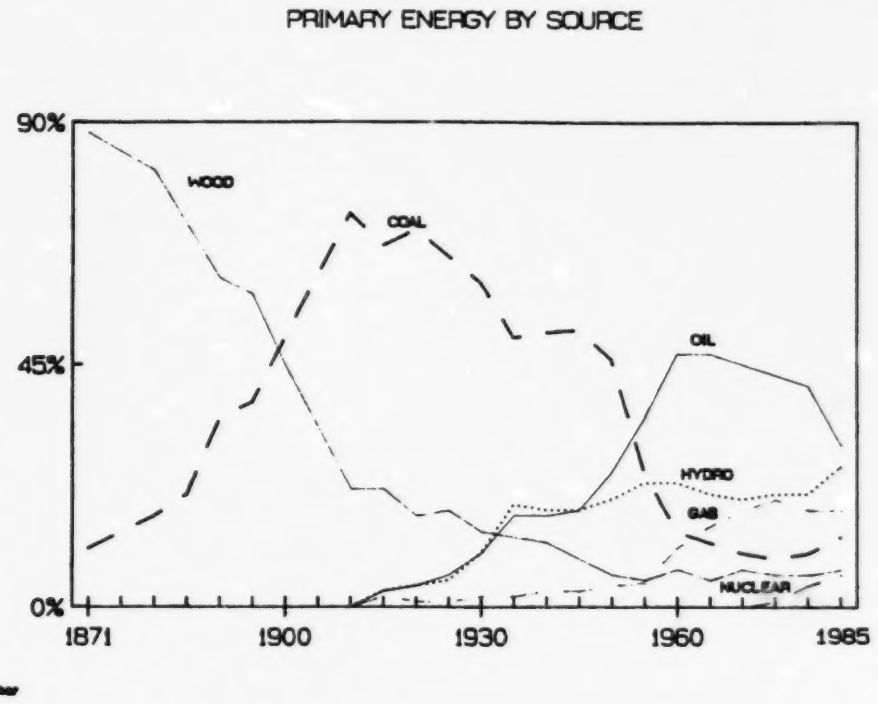
entrade

In 1985, Canada was a net exporter of all energy commodities. Energy exports amounted to $17 billion and energy contributed just over $11 billion to Canada's trade surplus. Canada is self-sufficient in uranium, natural gas and electricity. It imports about one quarter of its crude oil requirements, primarily for consumption in the Maritime Provinces and parts of Quebec. Roughly 20 per cent of Canada's coal needs are met by imports.

The United States is by far our most important trading partner in energy. In 1985, 86 per cent of the value of Canada's energy exports were destined for U.S. markets, whereas the U.S. supplied 33 per cent of the value of our energy imports, mostly coal for electricity generation in Ontario. Japan is a significant market for our coal, and Japan and the European Economic Community are important buyers of our uranium.

3.0 CHANGING ROLE OF ENERGY IN CANADA

3.1 Diversification

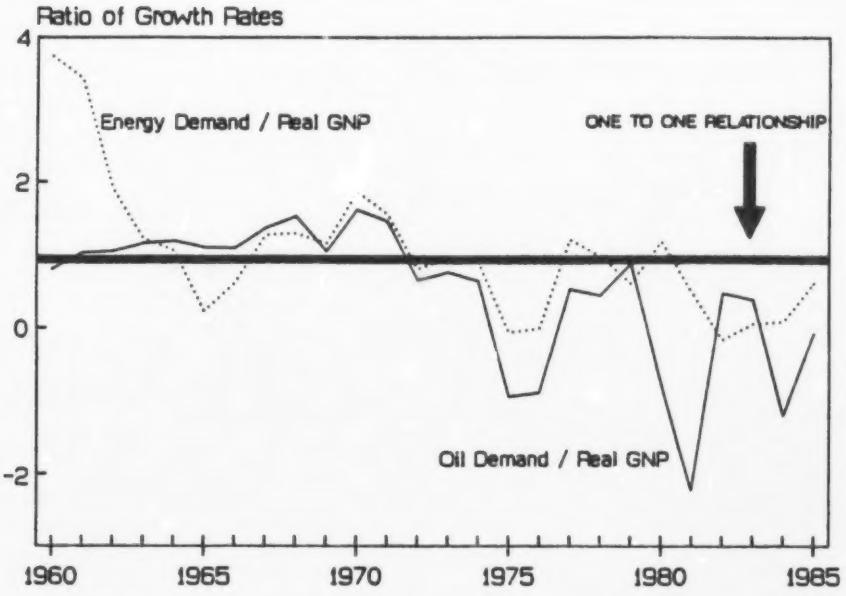


Canada has gone through three distinct 'energy eras'. In the late 1800s, wood gave way to coal. The transition from coal to oil began in the 1930s and accelerated rapidly during the industrial expansion following World War II, driven by the increasing availability of large quantities of low-cost oil, the widespread adoption of diesel engines, and the clean-burning characteristics of oil relative to coal.

Oil consumption reached its peak in relative terms in the mid-1960s, and has been declining rapidly since 1980 in response to the two oil price shocks, the development of substitutes, and the changing structure of our economy. At the same time, electricity from hydro power and nuclear power is increasing as is natural gas, and coal's share has begun once again to climb. Canada's energy system is becoming increasingly diversified and most forecasters predict that the future holds much more balance in the role of different energy commodities, with more competition and switching between sources.

3.2 Energy Use and Economic Growth

GNP GROWTH, ENERGY DEMAND GROWTH
& OIL DEMAND GROWTH



two years moving average

The relationship between economic growth, as measured by Gross National Product (GNP) and energy demand involves numerous factors, including changes in energy prices, technology, the structure of the economy and business cycles. In Canada, this relationship has changed over the last two decades, primarily as a result of structural changes induced by higher energy prices and made possible, in part, through technological advances.

In the 1960s, primary energy demand increased, on average, at a slightly faster rate than economic output: 5.4 per cent per year compared with 5.2 per cent. In comparison, oil demand increased much faster than economic output (6.2 per cent a year), largely as a result of abundant, low-cost supplies of oil. Canada, like other industrialized countries, became an oil-intensive economy during the 1960s. In the 1970s, however, the relationship changed. Since 1973, Gross Domestic Product has increased at an average annual rate of 2.8 per cent, compared with energy demand and oil demand growth rates of 1.4 per cent and -1.5 per cent, respectively.

Although oil consumption is rising once again, its rate of increase and that of energy in general is less than that of economic activity. In 1985, energy demand increased by 0.6 percentage points for every one percentage point increase in Gross Domestic Prod t, while oil demand increased by 0.5 percentage points.

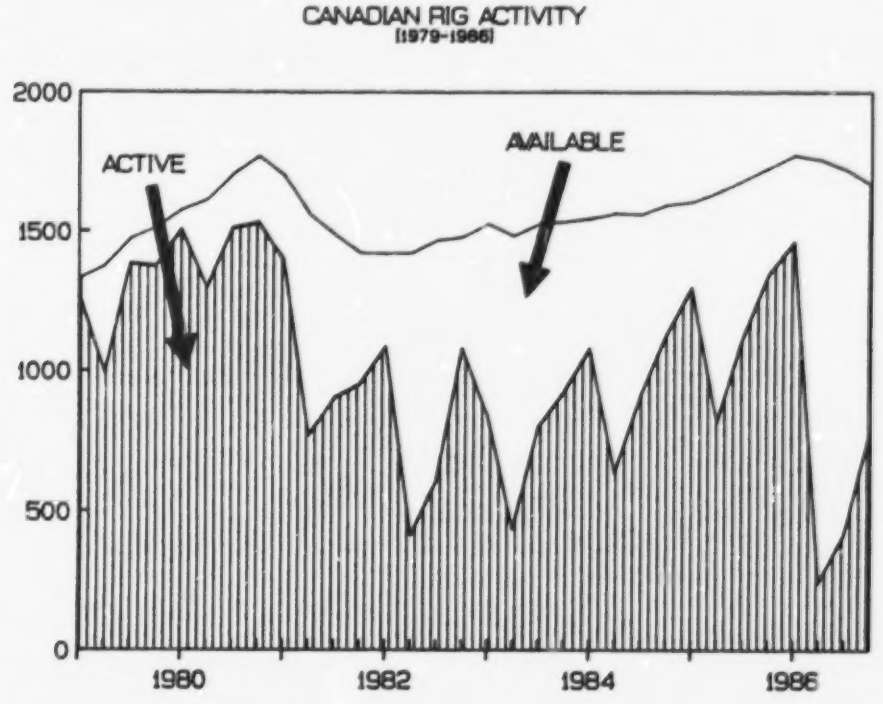
The rapid run-up in oil prices in the 1970s prompted major efforts to reduce energy use, particularly oil consumption, through conservation and substitution. These fundamental changes in the way Canadians consume and produce energy were part of a broader structural shift in the economy away from heavily material - and energy-intensive products and processes brought about by the spreading application of new high technology. The development of fibre optics is illustrative: to produce glassfibre cables requires only 5 per cent of the energy necessary to produce a copper cable capable of carrying the same number of telephone messages. This shift towards less resource intensive products and processes has far-reaching implications for Canada's primary industries, many of which have seen a sharp drop in prices.

At the same time, these structural changes combined with Canada's vast and low-cost electric power resources have made Canada the most electricity-intensive economy in the world, consuming almost twice as much per unit of economic output as the United States. Since 1960, growth in electricity consumption in Canada has consistently outpaced economic activity.

4.0 THE PROBLEMS

4.1 Economic Restructuring

Petroleum Sector



The precipitous fall in world oil prices and the volatility in the marketplace have had a devastating impact on the petroleum sector. Drilling activity, a sensitive barometer for the industry, dropped to record lows in mid-1986. There was an increase in activity in late 1986 as companies hurried to take advantage of Alberta's drilling incentives before the end of the program.

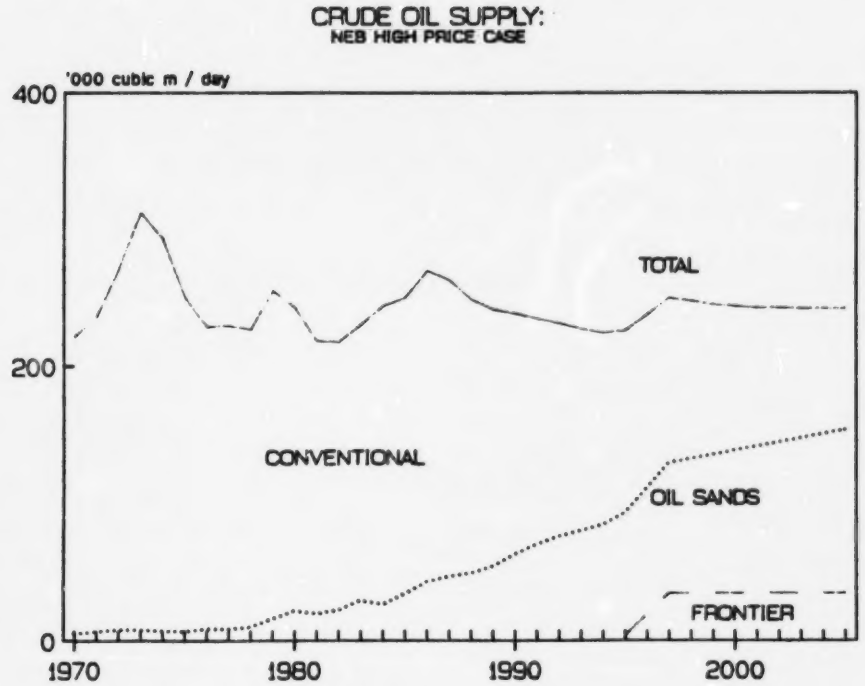
Prices for light crude dropped to less than $US 10/bbl in August of 1986. Since then, OPEC has succeeded in exercising some restraint on production: prices were around $US 14 to 15 for the latter part of 1986 and have risen to more than $US 18 since OPEC's December accord. Although prices have improved substantially from their lowest point, they remain well below those of the last decade and their demonstrated volatility has seriously shaken the confidence of the petroleum industry.

The low prices in 1986 are estimated to have reduced the upstream oil and gas sector's cash flow by 37 per cent in 1986. Cash flow is a critical determinant of investment in the oil and gas industry. Investment fell by an estimated 30 per cent last year, from $8 billion to $5.6 billion.

Both the federal government and the governments of the producing provinces have moved to improve the cash flow and investment climate for the industry. The federal government accelerated the termination of the Petroleum and Gas Revenue Tax. Alberta introduced temporary tax and royalty credits, and special incentives, and subsequently announced a significant package of royalty rate changes and royalty holidays. Saskatchewan has recently lowered its royalty rates. These measures are very important, but they are not able to compensate fully for the large drop in oil prices.

The difficulties faced by the petroleum sector have slowed economic growth in the five provinces in which the upstream industry is well represented: Newfoundland, Nova Scotia, British Columbia, Saskatchewan and Alberta. The Economic Council of Canada, in its recent report Changing Times, estimated that 50 per cent fall in oil prices would reduce average annual economic growth (real domestic product) over the period 1986 to 1991 by 7.5 percentage points in Alberta and 2.7 percentage points in Saskatchewan.

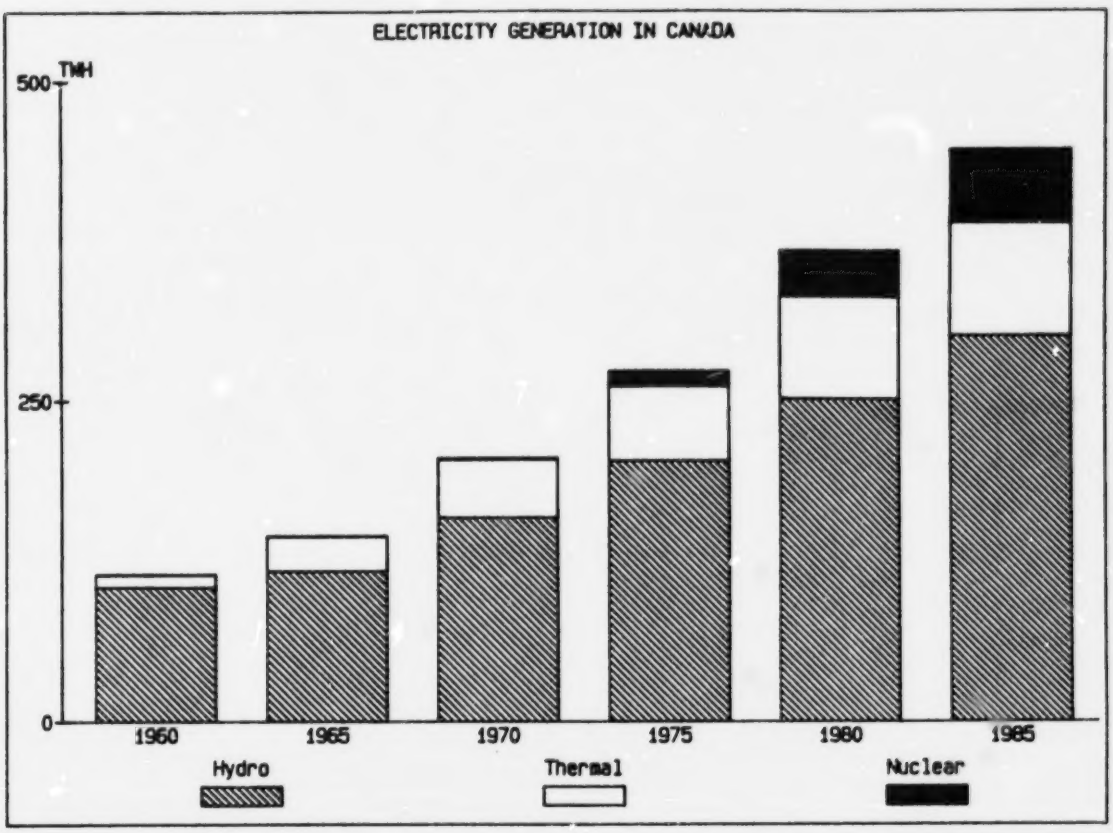
Rig activity levels in 1987 could improve should the recent strengthening of world oil prices prove to be sustainable. The Department of Energy, Mines and Resources, for example, estimates that an increase in oil prices from $US 15/bbl to $US 18/bbl would increase cash flow by almost one third and industry investment may see some improvement over the low levels of the second half of 1986.



The expected decline in conventional oil reserves points to another form of restructuring within the petroleum sector. Increasingly, Canada's domestic oil production will come from nonconventional and frontier oil reserves. The high cost of production from these sources, along with the lower and more uncertain outlook for oil prices, suggests that profit margins on projects will be lower, affording much fewer government revenues than in the past. At the same time, some of these projects may require governments to assume some portion of market risks if they are to proceed.

In contrast, natural gas will be sourced predominantly from the natural gas prone conventional areas of Western Canada for some time. Under its high-price scenario, the National Energy Board forecasts frontier gas production commencing in 1990, as representing less than one per cent of productive capacity, and peaking in the late 1990s at 14 per cent of total productive capacity.

Electrical Sector



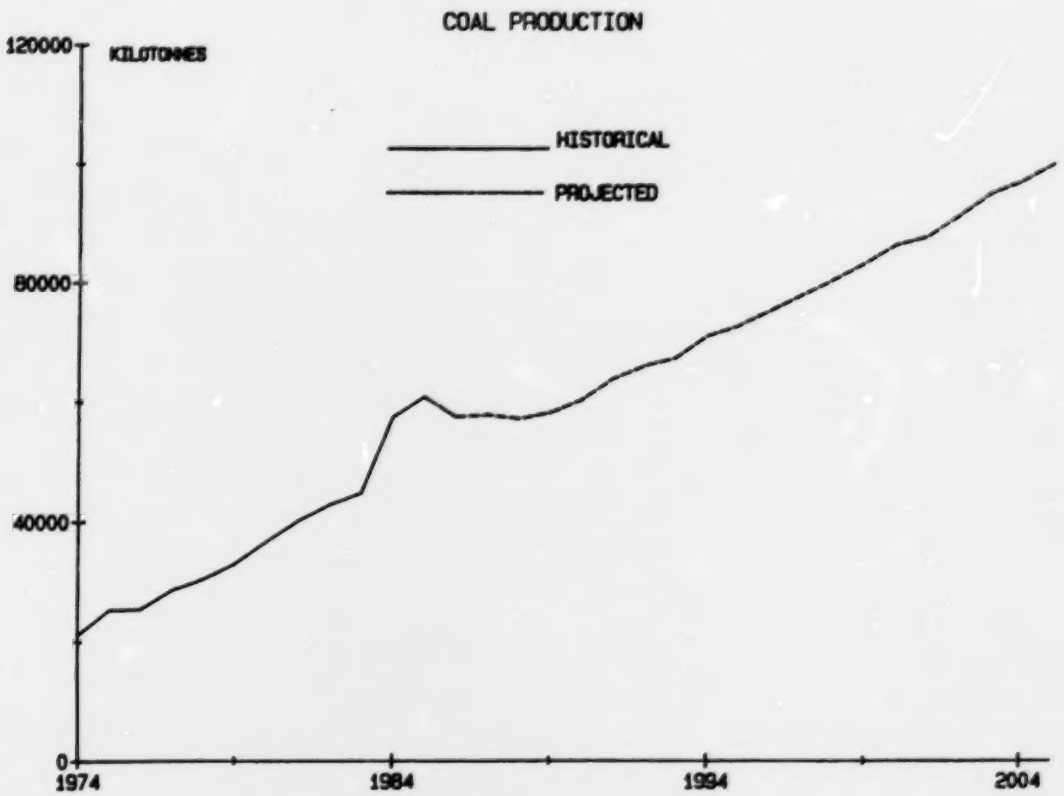
Because Canadian utilities are on average much less reliant on oil-based generation than those of other countries, the impact of oil price fluctuations is less direct and less immediate. Historically, expansion in the electrical sector has been a function of economic growth rather than oil prices. Indirectly, however, the price shocks of 1970s impeded expansion in the sector by slowing economic activity. Another fundamental change, stemming at least in part from the oil price shocks, is that the relationship between electrical energy use and economic activity is no longer as stable as it was in the past. This has left most utilities, which were planning for growth in the range of 7 per cent a year, with large excess capacity in the short term, beyond requirements for adequate reserve margins.

Although Canadian utilities have been able to postpone decisions about new capacity because of the current excess capacity, rising domestic electricity requirements (average of 4 per cent a year between 1975 and 1985) and

the long lead times necessary for base load generation facilities, will force utilities to commit themselves to a new round of investment in the near future.

Canadian utilities are expected to invest some $6 billion to $7 billion a year until 1995, adding new generation, transmission and distribution facilities. There is also potential for further growth in the sector from hydroelectric power exports to the United States, particularly from Newfoundland, Quebec, Manitoba and British Columbia.

Coal Sector



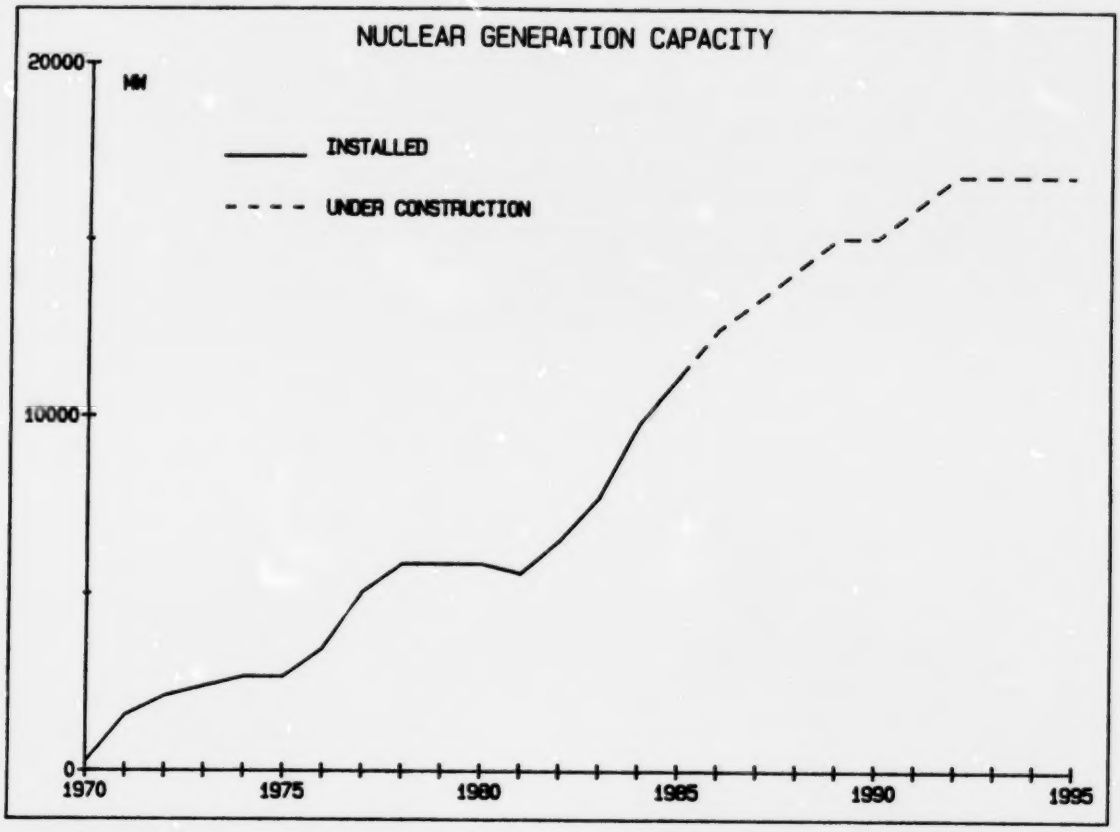
The historical growth in demand for coal can be attributed to a growing domestic market for thermal coal, and increasing worldwide demand which led to expanding exports. Until recently, the Canadian coal industry benefited from industrial expansion in Japan and Korea, which gave rise to substantial exports of metallurgical coal, and from the escalation of world oil prices, which led to increased exports for thermal coal. In contrast to this sustained expansion, preliminary figures for 1986 suggest that domestic coal consumption was down by 5 per cent from 1985. Virtually all of this decrease is accounted for by reductions in coal consumption by provincial electrical utilities.

The state of the industry is a direct function of energy demand, particularly electricity, and the price of competing fuels. Interestingly, the export demand for metallurgical coal appears to be sensitive to energy prices over the long term. The economic slowdown caused by the run-up in oil prices during the 1970s caused a decline in the rate of growth in demand for steel. In addition, steel was displaced in some applications by less energy intensive substitutes, leading to an oversupply of metallurgical coal and sharp price reductions in world markets.

Over the past three to four years, coal prices have been declining as a result of a global oversupply . New production from Colombia and Poland is selling at below full cost. Further, demand for coal has not kept pace with expectations, partly because of increased competition from oil. Faced with shrinking coal markets, coal producers around the world are renegotiating contracts at prices that are 10 per cent less than last year's.

The National Energy Board's forecast of coal production indicates relatively flat demand over the next few years, rising thereafter under both its price scenarios. The Board cautions, however, that the forecast is fraught with major uncertainties concerning domestic thermal requirements. For example, the Board assumes that coal, not nuclear energy, will be used to generate additional electrical power requirements in Ontario beyond 1995. Future coal exports are expected to continue to be largely metallurgical, remaining at current levels until 1990 and increasing modestly thereafter.

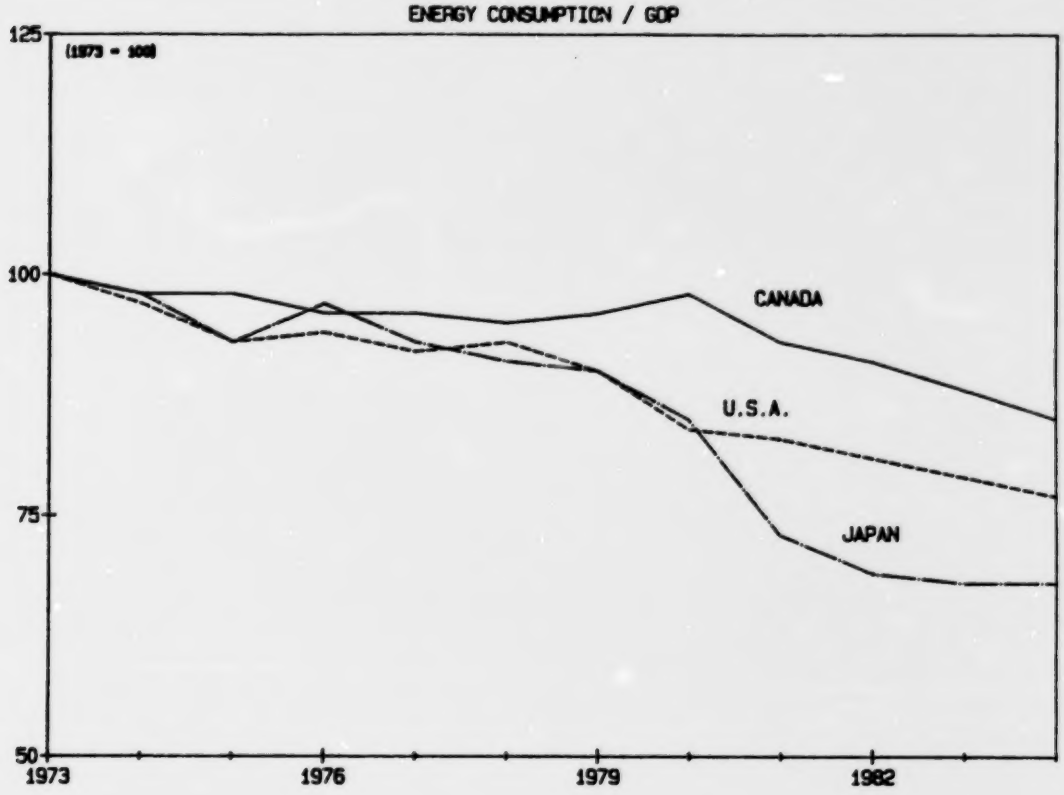
Nuclear Industry



Between 1970 and 1984, the nuclear industry's share of total electrical generation capacity increased from 0.5 per cent to 13.0 per cent. Expansion has been concentrated in Ontario where there are currently 21 CANDUs operating or under construction. Quebec and New Brunswick have one each. But orders placed in the mid-1970s were based on expectations of stronger electricity demand growth than was realized.

The CANDU technology has had an exemplary record of cost, dependability and safety, which has earned it worldwide respect. Canada has sold nine reactor units internationally and is ranked second behind the United States in international reactor unit sales. The global export market for nuclear reactors in the coming decade will likely be small and all nuclear industries must depend first on their home markets. The potential market for CANDU's in Canada is centred in Ontario, though some possibilities exist in Atlantic Canada and in the West. It is not clear when decisions by domestic utilities regarding the next major additions to capacity will be made. In the interim, the export market could be important in sustaining the core of our nuclear industry.

4.2 Energy Efficiency



As already noted, Canada is the most energy-intensive industrialized country in the world. Although energy use per unit of Gross Domestic Product fell 9 per cent between 1973 and 1984, this was substantially less than the average decline of 23 per cent realized by all OECD countries. Between 1973 and 1979, when domestic oil prices were held substantially below world prices, total efficiency of energy use remained unchanged in Canada. Virtually all of the improvement in Canada's energy efficiency occurred after 1979, stimulated by the combined impact of conservation programs, world oil price increases, and the gradual elimination of low domestic oil prices.

In contrast, Canada has been very successful in reducing its reliance on oil. Between 1973 and 1985, petroleum's share of the Canadian market fell from 54.5 per cent to 39.4 per cent. This reduction in domestic demand oil was the result of efficiency improvements in the transportation sector, and conversions to natural gas in central Canada, to electricity in Quebec, and to renewable fuels such as wood in eastern Canada. Furthermore, some diversification has been obtained through the increased use of natural gas, propane and alcohol fuels in the transportation sector.

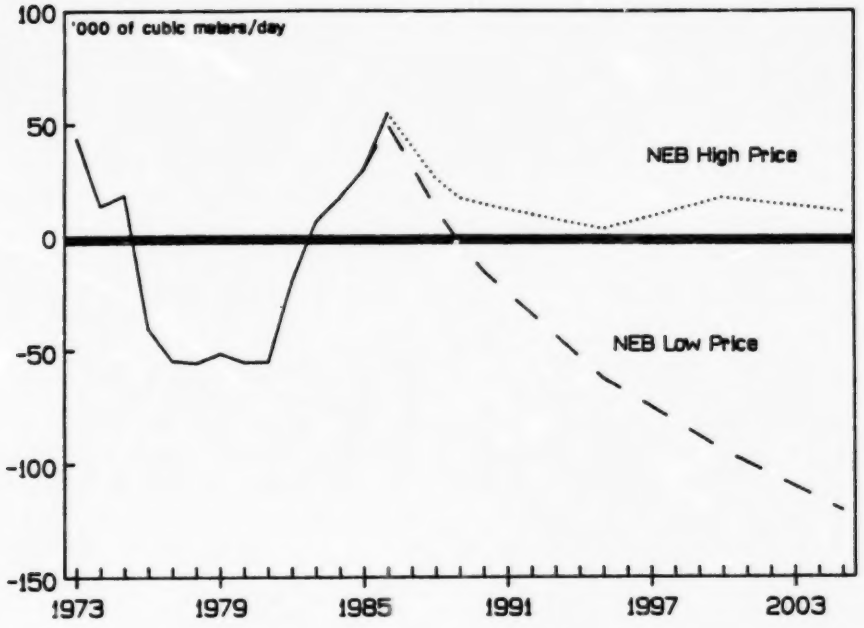
There is some concern that lower oil prices will jeopardize the significant gains that have been made in energy and oil use efficiency as well as oil substitution. These concerns are legitimate but they should not be overdrawn. The momentum behind energy conservation is very strong and gains should continue into the future. For example, we are only beginning to see the impacts of the 1979 price shock as the capital stock in housing, industry and transportation replaces older, less energy efficient structures and equipment with buildings, machines and cars that use modern, energy saving technology. Substantial reversal of the energy conservation and substitution trends of past the decade is not expected.

Moreover, despite low oil prices, many energy-saving investments remain economically attractive. In total, the Department of Energy, Mines and Resources estimates that more than 15 per cent of current energy use would be saved if all attractive investment opportunities were undertaken. Although this would not reduce our consumption per unit of GDP dramatically, when adjusted for factors such as industrial, geographical and climatic differences, our energy use would likely approach the efficiency levels of even the most efficient of the OECD countries.

The largest potential for further energy savings lies in the industrial and commercial sectors, although there is also significant potential for reduced energy use in the residential sector. Financial and technical barriers will have to be overcome, but there remains significant potential for further oil substitution and conservation, particularly in the transportation sector.

4.3 Energy Security

CANADA'S NET CRUDE EXPORTS



Canada is now a net oil exporter, but in recent history this status was the exception rather than the rule. For most of the 1970s and for the early 1980s, Canada was a net oil importer. For example, at the time of the 1979 oil crisis, Canada's net imports stood at about 50,000 cubic metres a day. Despite this dependence, we experienced no shortages of vital oil supplies. And despite using our substantial domestic petroleum production to cushion ourselves from rapid price increases through price controls, we proved unable to insulate ourselves from the global economic impact of the 1979 price shock.

The prospects for maintaining Canada's status as a net oil exporter have diminished with the fall in oil prices. Nonetheless, whether Canada will again become a net oil importer is uncertain. Even if we adopt the National Energy Board's most recent scenarios, which are based on two rather pessimistic views of prices, Canada remains self-sufficient in oil beyond the turn of the century under the high-price case. And although we will revert to a net oil import status in the late 1980s under the low-price case, Canada will remain a net energy exporter into the late 1990s.

In the case of light crude oil, the Board projects that eastern and central Canada would become increasingly dependent on imports under both price scenarios. Net light crude oil imports would increase from 5 per cent of total light crude requirements in 1986 to 43 per cent by 1995 under the low-price case, and 36 per cent under the high-price case. The Board, however, notes that considerable uncertainties remain. For example, it indicated that its assumption regarding the availability of synthetic light crude oil from mining plants was too conservative under the high-price case.

Such scenarios are a vital policy tool, but it is important to reflect on these uncertainties and their implications. In 1979, the Department of Energy, Mines and Resources forecast net oil imports of between 550 million and 600 million barrels a day in 1985. In fact, Canada was a net oil exporter of 190 million barrels a day in that year, with capacity to export a further 125 million barrels a day. Similarly, only two years ago the National Energy Board forecast Canada would likely be a net exporter of oil beyond the turn of the century.

The energy security of Canada and other Western industrialized countries depends not only on the quantity of oil imports, but also on other factors, including:

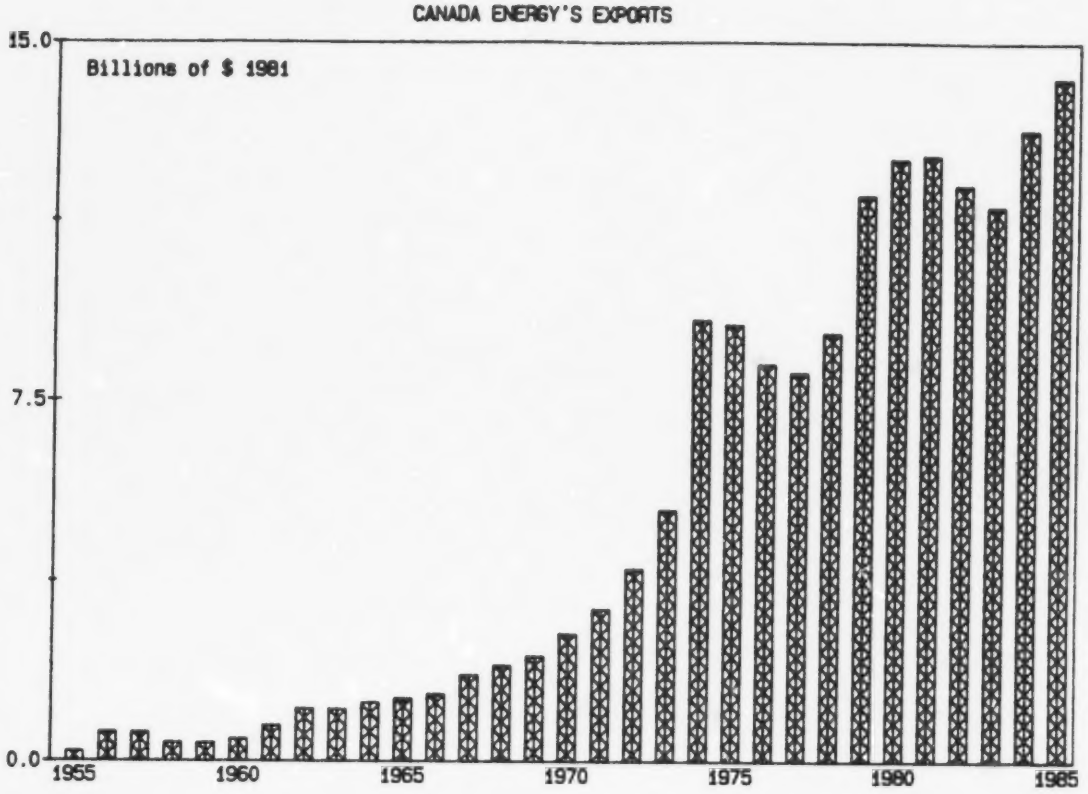
- diversity of our oil supplies
- the availability of excess production capacity, domestically and internationally
- the balance in the mix of fuels in the economy
- the availability of alternative fuels
- the ability of the energy system to switch between fuels
- the level of domestic and international oil stocks
- emergency preparedness

Of equal importance are the permanent changes in global and domestic energy systems. As already noted, oil consumption in Canada has dropped dramatically. Between 1973 and 1985, petroleum's share of the Canadian market fell from 54.5 per cent to 39.4 per cent. At the same time, Canada has become increasingly reliant on a variety of domestic energy sources, including natural gas, electricity and coal.

The international energy system has become more diverse and more flexible. For example, dual- fired (coal - oil and natural gas - oil) fired capability in the industrial and electrical generation sectors in OECD countries is at almost 4 million barrels a day. There also has been a rapid buildup of government-owned or controlled oil stocks, increasing from essentially zero in 1973 to 710 million barrels at present.

The Government of Canada has in place an emergency energy allocation system. The Energy Supplies Allocation Board, established in 1974, enables the Government of Canada to ration and reallocate supplies of energy in the event of a disruption in supplies. As well, Canada is a member of the International Energy Agency, whose members have agreed upon a system to deal with any oil supply emergency in which there is a reduction in oil supplies of at least 7 per cent.

4.4 Energy Trade



Trade has played an important role in the growth and development of Canada's energy industries, accounting for an increasing proportion of the value of energy sales. The United States is by far our most important trading partner, accounting for $15 billion or 86 per cent of total energy exports. All of our natural gas and electricity exports are destined for the United States and 100 per cent of our oil exports enters U.S. markets.

Canada remains an important and secure source of energy supplies for the United States. Canada is the largest foreign supplier of oil and oil products to the United States, representing 13 per cent of total imports and 3 per cent of total U.S. requirements. Canada currently supplies the United States with 4 per cent of its natural gas and almost 2 per cent of its electricity.

The policy of the Government of Canada since 1984 has been to dismantle the complex system of regulations and controls that impeded the energy sector's economic development. The government's market-oriented approach has led to increased access for producers to both domestic and export markets. The Western Accord reduced restrictions on the export and import of crude oil and petroleum products. Restrictions on natural gas exports have also been significantly relaxed and further policy changes are being considered at both the federal and provincial level. The National Energy Board is also reviewing the approval procedure for electricity exports, with a view to simplifying the procedures and remaining impediments to electricity trade.

Much progress already has been made in establishing the basis for freer trade in energy. At the Quebec Summit meeting between Prime Minister Mulroney and President Reagan in March 1985, the two leaders agreed to work towards removing barriers to trade for oil, coal, natural gas and electricity. In the context of bilateral negotiations for a possible comprehensive trade agreement, Canadian and American representatives are examining barriers to all trade.

But these gains are now being threatened by increasingly protectionist sentiment in the United States against imports of uranium, electricity and natural gas from Canada. Recent developments in the United States are already affecting market access and the competitiveness of Canada's energy exports.

Crude oil and petroleum products, for example, already face import tariffs in the United States, whereas imports of all oil into Canada are tariff free. The levies which came into effect on January 1, 1987, to pay for the environmental Superfund, discriminate against foreign oil. These, and the customs user fees that affect all imports, will further reduce the export revenues of Canadian producers and refiners. Also of concern is the prospect of an oil import tariff, which is gaining increasing support amongst representatives of the petroleum industry and energy-producing states, even though it is opposed by the Administration. An oil import tariff would have a severe impact on Canada's oil producing and refining sector.

The competitiveness of Canadian gas exports in the U.S. market would be very adversely affected if the December 1986, ruling of the U.S. Federal Energy Regulatory Commission, regarding the pass-through of Canadian natural gas costs to U.S. consumers, is confirmed. This decision would prevent Canadian gas

exporters from recovering the full costs of gas sold to the United States, thereby reducing the returns to Canadian producers from export sales. Canada's natural gas exports also have been adversely affected by the Federal Energy Regulatory Commission's decisions regarding access to U.S. pipelines.

Canada's electricity exports are also facing protectionist pressures. The intertie access policy of the Bonneville Power Administration, a marketing agency of the U.S. government, impedes British Columbia's access to the California electricity market. This situation is of concern both to British Columbia, and to California utilities, which see Canada as a secure and competitive source of electricity. In the eastern United States, concerns have been voiced about too great a dependence on electricity imports in place of domestic generating capability.

During 1986, several legislative and court initiatives in the United States aimed at restricting imports of foreign uranium. Because of the resultant uncertainties, U.S. utilities are reluctant to enter into new long-term supply contracts.

4.5 Energy and Technology

Technological advances have played a key role in altering the makeup of Canada's energy system. Technology has altered the way in which Canadians produce and consume energy, increasing the diversity of sources and increasing flexibility of consumption.

Federal spending on energy R&D increased from $44 million in 1979 to $170 million in 1984. There have also been significant provincial expenditures in energy R&D totaling $101 million in 1985-86. Recently, budgetary restraints have forced both levels of government to reduce funding on R&D. Federal expenditures are expected to total $88 million in 1987-88.

Energy conservation technologies have provided the technical basis for increasing the efficiency of energy use and shifting demand away from oil. Advances in the agrifood sector, construction industry and transportation are responsible, in part, for significant improvements in energy efficiency in Canada.

Technological innovation has also contributed to a growing diversity in energy sources. The CANDU nuclear technology is illustrative of Canada's achievements. Canada is also at the forefront of hydroelectric power technology. Aided by rising energy prices and government support, Canada has made important strides in the development of renewable energy technologies such as biomass, wind and solar. The products and technologies developed represent a remarkable range of accomplishments in basic thermal conversion processes, improved materials, product design and manufacturing techniques, and improved cost effectiveness.

Advances in oil and gas exploration and production technologies have helped lower some of the technical barriers to the full realization of Canada's frontier petroleum potential while also improving on cost effectiveness and safety. Similarly, research and development into improving recovery efficiencies for oil sands and heavy oil have also been a priority.

Improvements in alternative transportation fuel technologies have facilitated significant substitution of oil products by propane, compressed natural gas and alcohols such as methanol. Much greater substitution in the future could be possible through technologies now being demonstrated. Technological achievements in the development of longer-term options such as hydrogen-powered and electrically-powered vehicles provide further potential for substitution.

As Canada becomes more reliant on less accessible and higher cost energy supplies, technology will play an increasingly important role. Through technological innovation, costs can be reduced, harsh environmental constraints overcome and difficult technical problems surmounted. New technologies will also be vital to increasing energy demand flexibility, by enabling the use of a variety of energy sources for the same end use and mitigating the adverse environmental impacts of energy resource development.

4.6 Energy and the Environment

Public awareness and concern regarding environmental protection is widespread in Canada today. Evidence of this can be seen in the difficulties facing Canada over the issue of acid rain. As a result, environmental considerations are playing an increasingly important role in the development and use of Canada's energy resources. Each source of energy and its consumption carries environmental consequences ranging from small, mitigable impacts from, for example, wind turbines, to long-term irreversible global effects from burning fossil fuels (e.g., CO_2 buildup leading to climate change). Consequently, not only is energy production and consumption subject to specific environmental regulations but also changes in either areas must bear the scrutiny of public environmental reviews.

The requirement to be sensitive to environmental issues has led industry and government to consider environmental factors at a very early stage in project planning and to provide appropriate environmental safeguards for projects, often at considerable cost. This trend will continue and broaden to include program and policy decisions as Canada requires new energy capacity.

It is fair to say that environmental consequences will have to be considered at the same level as economic and technical factors, whether it be increasing offshore oil and gas activity, developing the oil sands, constructing large-scale hydro projects, increasing the use of nuclear energy, or producing more electricity by burning coal. In each case, environmental impacts, not only at the local but also at the regional and global levels, must be manageable and publicly acceptable. However, this may not be enough. The very mix of energy sources in the future may increasingly be determined on the basis of environmental consequences rather than just traditional technology and economics.

5.0 ROLE OF GOVERNMENTS

Canada faces difficult energy issues that clearly transcend regional and even international boundaries. Like other industrialized countries, Canada is being strained by underlying structural changes in the way energy and other primary products are consumed and produced. This has led to depressed demand and downward pressure on primary commodity prices in most sectors. In energy, however, the problems are compounded by uncertainty arising from the presence of a strong but volatile institutional force, OPEC.

Given this context, an important question is, What roles should governments assume?

5.1 Historical Roles

Under our constitution, natural resources belong to the provinces. Thus it has been the provinces which have had primary responsibility for establishing the regulatory and fiscal regimes shaping energy resource development. The provinces have played an especially important role in electricity production, where provincially owned utilities predominate.

The federal government's role has varied over time and among energy commodities. It has been most prominent in relation to the petroleum and nuclear energy sectors. It has also played a supportive role regarding coal, conservation, renewable energy and energy research and development. As well, it has exercised its constitutional responsibilities regarding interprovincial and international trade.

The federal government's role in relation to oil and gas focussed initially on the development of the transportation infrastructure necessary to carry western oil and gas to eastern markets. The National Oil Policy in 1961 marked a first step towards a more interventionist policy designed to ensure Canadian markets for western oil. The 1970s gave rise to national concerns about the security of oil supplies and the distribution of Canada's petroleum wealth. The latter became the subject of great national debate and divisiveness. The National Energy Program in 1980 marked the culmination of an interventionist role for the federal government.

5.2 Current Role of the Government of Canada

On March 28, 1985, the Government of Canada and the governments of the three producing provinces, Alberta, British Columbia and Saskatchewan, reached a comprehensive agreement on petroleum, pricing, taxation and marketing. The Western Accord was a milestone in the history of Canadian energy policy. Not only did it begin the process of dismantling the complex and discriminatory National Energy Program, but for the first time in more than a decade, Canadian energy markets were freed from government negotiations.

Government intervention in oil markets ended on June 1, 1985, with the deregulation of oil prices. The Western Accord, followed by the Agreement on National Gas Markets and Prices on October 30 in the same year, began to dismantle regulatory barriers to the competitive marketing of natural gas. Consistent with this policy, the Government established a new framework governing petroleum exploration and development on Canada's Frontier Lands. This initiative, announced on October 30, 1985, set out a stable management regime, a profit-sensitive royalty regime, nondiscriminatory and regionally balanced exploration incentives, and fair Canadianization requirements.

The Government of Canada also embarked upon a new direction in conservation and renewable energy policy. The costly and interventionist programs of the NEP were curtailed and replaced with a package that relied more on market forces to drive consumers' choices: the National Conservation and Alternative Energy Initiative (NCAEI).

These and other initiatives reflected the Government of Canada's commitment to a market-oriented policy. It was a policy framework designed to avoid the mistakes of the past. Energy production and consumption patterns would be driven by the decisions of consumers and businesses responding to market forces. It was a policy built on consensus among Canadian consumers and producers and from east to west. All recognized that there were mutual benefits. For consumers it meant a greater choice of energy sources, and for producers, it provided greater access to markets.

In spite of the dramatic change in world energy markets, the Government of Canada has remained committed to a market-oriented approach and maintained its agenda. On October 30, 1986 the Government moved forward with the deregulation of domestic gas markets with the announcement of important initiatives concerning export pricing and controls. Again, the parties involved recognized that important benefits could be achieved by moving away from the rigidity of regulated prices.

In responding to the oil price collapse, the Government, to date, has followed a two-pronged approach: adjusting the fiscal system and continuing to review mega projects case by case. Already the fiscal regime has been adjusted: the Petroleum and Gas Revenue Tax was eliminated effective October 1, 1986. The Government of Canada has provided assistance for the construction of the Newgrade upgrader in Saskatchewan and for engineering studies on the Bi provincial upgrader at Lloydminster. Negotiations continue on a fiscal package for the Hibernia oil project off Newfoundland. The government has encouraged the delineation of the major Amauligak discovery in the Beaufort Sea. The Government is also engaged in an active policy review of its current conservation and alternative energy programs in consultation with the provinces, to determine the shape of the federal role in conservation and alternative energies after 1988, when the program is scheduled to expire. Finally, the Government of Canada continues to support energy research and development into technologies that could assist Canada in achieving greater efficiency and diversity in its consumption and production of energy.

5.3 Future Role of the Government of Canada

Today, the Government of Canada is under increasing pressure to intervene, once again, in oil and gas markets in response to low and uncertain oil prices. There are renewed calls for further initiatives in energy conservation and alternatives. The Government of Canada also faces some difficult choices concerning its role in the nuclear sector.

The first step in determining the role of governments is to work towards developing an understanding of what needs to be done. What items are common to the agendas of both levels of government?

- Protecting our energy security.
- Maintaining access to foreign markets.
- Sustaining the nuclear option.
- Easing restructuring in the petroleum sector.
- Encouraging energy conservation and alternatives.
- Supporting energy research and development.
- Facilitating greater integration of environmental impacts in energy investment decision-making and policy.

These issues will be the subject of public debate in the coming months. The intergovernmental conference of energy ministers provides and important forum for their examination.